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Reading Abilities and Phonological Skills of Second Grade Children with Three Different Language Histories: Normal, Delayed, and Chronically Delayed

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THESIS APPROVAL

The abstract and thesis of Candace Jane Murray for the Master of Science in Speech Communication: Speech and Hearing Science were presented January 11, 1996, and accepted by the thesis committee and the department.

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ABSTRACT

An abstract of the thesis of Candace Jane Murray for the Master of Science in Speech Communication: Speech and Hearing Science presented January 11, 1996.

Title: Reading Abilities and Phonological Skills of Second Grade Children with Three Different Language Histories: Normal, Delayed, and Chronically Delayed

This study was part of the Portland Language Development Project, a longitudinal study of early expressive language delay. Its purpose was twofold. The first was to examine phonological and reading abilities in second grade children with a history of language delay. The second purpose was to examine the relationship between phonological processing abilities and reading skills in these children.

Second grade children were assigned to one of three groups, based on their history and current Development Sentence Score (DSS) score: (a) normal language (NL), those with more than 50 words at 20-34 months and above the tenth percentile on the DSS; (b) history of delay, but currently normal expressive language (HX), those with fewer than 50 words at 20-34 months and above the tenth percentile on the DSS; and (c) history of delay with continued performance below normal (ELD), those with fewer than 50 words at 20-34 months and below the tenth percentile on the DSS. The children were evaluated by means of the Reading Recognition and Reading Comprehension subtests of the Peabody Individual Achievement Test (Dunn & Mackwardt, 1970), three complex phonological production tasks, and the Lindamood Auditory Conceptualization Test

(LAC) (Lindamood & Lindamood, 1979), which assesses phonological awareness.

This study compared the reading and phonological scores of the three groups to determine if there are any significant differences. The results showed no significant differences in reading abilities. There were significant differences on the complex phonological task of naming pictures, between the NL and HX group, and there were significant differences on the LAC, between the NL group and the ELD group, and between the HX group and the ELD group.

Reading and phonological scores of the children with a history of late talking were correlated, using a regression analysis to determine whether reading recognition and reading comprehension could be predicted from the phonological production and LAC tasks. The LAC was the only variable that correlated with the Reading Recognition or Reading Comprehension subtests. The LAC accounted for 39% of variance of the Reading Recognition score, and 27% of the variance of the Reading Comprehension score.

READING ABILITIES AND PHONOLOGICAL SKILLS OF SECOND GRADE CHILDREN WITH THREE DIFFERENT LANGUAGE HISTORIES: NORMAL, DELAYED, AND CHRONICALLY DELAYED

by

CANDACE JANE MURRAY

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CHAPTER I

INTRODUCTION AND STATEMENT OF PURPOSE

Introduction

Many children who have slow expressive language development (SELD) as toddlers appear to outgrow their delay, but some children continue to exhibit chronic language delay (Rescorla & Schwartz, 1990). Some research suggests this delay may persist through the late preschool period into the school-age period (Aram & Nation, 1980; Butler, 1988; Catts, 1993; Padget, 1988; Paul, 1993; Paul, Laszlo, McFarland & Midford, 1992; Rescorla & Schwartz, 1990). As children enter school, they must be able to move beyond the oral language skills to meet the demands of metalinguistic language tasks. Since these skills rest on the foundation of basic oral language, children with delays in oral language development may be at risk for academic failure in subjects, such as reading, that rely on metalinguistic abilities.

Because success in academic achievement is closely related to reading achievement, there is a need to examine the reading abilities of children with a history of language delay. Determining if a history of language delay produces any residual deficits that may affect reading ability, even for children who appear to have outgrown their expressive language delay, is important for these children's future academic success (Scarborough & Dobrich, 1990). Phonological production skill and phonological awareness are closely linked to reading success, so phonological skills of children with a history of language delay deserve further study (Catts, 1986; Swank, 1994; Swank &

Catts, 1994).

Statement of Purpose

There were two purposes of this study. The first purpose was to examine reading skills and phonological processing abilities of second grade children with different language histories: those with normal language development (NL); those with a history of slow expressive language development (SELD) as preschoolers, but currently normal expressive language (HX); and those with a history of SELD who continue to perform below the normal range in expressive language (ELD). The second purpose was to determine if there were significant correlations among phonological production and phonological awareness abilities, and reading abilities for a group of second graders identified as SELD at the age of 2 years.

The following research questions were posed:

1. Are there significant differences in complex phonological production skills among second grade children with three different language histories: NL, HX, and ELD?

2. Are there significant differences in phonological awareness abilities among second grade children with three different language histories: NL, HX, and ELD?

3. Are there significant differences in reading abilities among second grade children with three different language histories: NL, HX, and ELD?

4. Is there a significant correlation among complex phonological production and awareness, and reading recognition skills for second grade children identified as SELD at the age of 2 years?

5. Is there a significant correlation between complex phonological production and awareness, and reading comprehension skills for second grade children identified as SELD at the age of 2 years?

The following research hypotheses were posed to answer the questions:

1. There are significant differences in complex phonological production skills among second grade children with three different language histories: NL, HX, and ELD.

2. There are significant differences in phonological awareness abilities among second grade children with three different language histories: NL, HX, and ELD.

3. There are significant differences in reading abilities among second grade children with three different language histories: NL, HX, and ELD.

4. There is a significant correlation among complex phonological production and awareness, and reading recognition skills for second grade children identified as SELD at the age of 2 years.

5. There is a significant correlation between complex phonological production and awareness, and reading comprehension skills for second grade children identified as SELD at the age of 2 years.

The corresponding null hypotheses were:

1. There are not significant differences in complex phonological production skills among second grade children with three different language histories: NL, HX, and ELD.

2. There are not significant differences in phonological awareness abilities among second grade children with three different language histories: NL, HX, and ELD.

3. There are not significant differences in reading abilities among second grade children with three different language histories: NL, HX, and ELD.

4. There is not a significant correlation among complex phonological production and awareness, and reading recognition skills for second grade children identified as SELD at the age of 2 years.

5. There is not a significant correlation between complex phonological production and awareness, and reading comprehension skills for second grade children identified as SELD at the age of 2 years.

Definition of Terms

The following terms are used throughout this study:

1. Complex Phonological Production: The production of complex speech sound sequences including complex words, and complex phrases.

2. Developmental Sentence Score (DSS): A standardized method developed by Lee (1974) to evaluate the syntactical complexity of children's speech samples. Utterances containing a subject and verb are scored for eight grammatical categories: indefinite pronouns, personal pronouns, main verbs, secondary verbs, negatives, conjunctions, interrogative reversals, and Wh questions.

3. Encoding: The ability to process speech by encoding the phonemic structure. The phonological structure is first identified, and then stored into long term memory.

4. Expressive Language Delayed (ELD) Subjects: Children who were late to talk as evidenced by a vocabulary of less than 50 words at 20-34 months and who scored

below the tenth percentile (a score of 8.11) on the Developmental Sentence Score (DSS) (Lee, 1974).

5. History of Expressive Language Delay (HX) Subjects: Children who were late to talk as evidenced by a vocabulary of less than 50 words at 20-34 months and who scored above the tenth percentile (a score of 8.11) on the Developmental Sentence Score (DSS) (Lee, 1974).

6. Metalinguistics: The ability to think about and consciously manipulate language.

7. Normal Language (NL) Subjects: Children who were normal in language development as evidenced by a vocabulary of more than 50 words at 20-34 months and who scored above the tenth percentile (a score of 8.11) on the Developmental Sentence Score (DSS) (Lee, 1974).

8. Phonological Awareness: The conscious ability to manipulate phonemes in spoken language.

9. Reading Comprehension: The ability to read a sentence and point to a picture corresponding to the sentence meaning as measured by the Reading Comprehension subtest of the Peabody Individual Achievement Test (Dunn & Mackwardt, 1970).

10. Reading Recognition: The ability to identify letters, words, sounds, and to read orally, as measured by the Reading Recognition subtest of the Peabody Individual Achievement Test (Dunn & Mackwardt, 1970).

11. Retrieval: The ability to retrieve phonological representations from long term memory.

12. Sensitivity: Accuracy in identifying those with deficits as impaired.

13. Slow Expressive Language Development (SELD): Children who are late to talk as evidenced by a vocabulary of less than 50 words at 20-34 months.

14. Specificity: Accuracy in identifying normals as normals.

CHAPTER II

REVIEW OF THE LITERATURE

Children who have an expressive vocabulary of less than 50 words at age 2 are considered late talkers, and are described as having slow expressive language development (SELD) (Paul, 1993; Rescorla, 1991). There are a number of studies which suggest these children with a history of late language development may continue to fall behind peers in language development throughout the preschool period (Bishop & Adams, 1990; Paul, 1993; Paul et al., 1992; Scarborough & Dobrich, 1990). There are also studies that indicate preschool children with language impairments may continue to have language deficits as they enter the school years (Aram, Ekelman, and Nation, 1984; Aram & Nation, 1980; Lewis & Freebairn, 1992; Padget, 1988; Stark, Bernstein, Condino, Bender, Tallal, and Catts, 1984).

For those children with SELD, the introduction of reading in the primary grades presents new challenges. Reading requires additional metalinguistic skills including phonological awareness and phonological processing skills. This study focused on reading achievement, complex phonological production skills, and phonological awareness of second graders with different language development histories: NL, HX, and ELD. This review of the literature examines the connections between language impairment and academic achievement, the development of children with SELD, and reading and phonological processing.

Language Impairment and Academic Achievement

There is a growing body of research describing the association between early language impairment and later problems with academics, especially reading. Several studies have examined language abilities of kindergartners, and followed with measures of reading in second grade. A study by Butler (1988) showed that oral skills at kindergarten correlated with reading success beyond the second grade level, and conversely, oral skill deficits at kindergarten correlated with reading impairments beyond second grade. Catts (1993) explored the relationship between speech-language impairments and reading by measuring language abilities in a group of kindergartners, and measuring reading achievement in the same children in second grade. His study showed an increased risk for reading disabilities among children with speech and language impairments.

Other studies have examined preschool children with speech and language impairments, and their later school and reading achievement. In a 5-year follow-up study on speech and language impaired 3- and 4- year-olds, Padget (1988) found that children with a speech and language disorder during preschool had a much higher risk for academic problems than the typically developing children. In their study, Aram and Nation (1980) found that 40% of children with preschool language impairments continued to have language deficits.

In a 10-year follow-up study of preschoolers with language disorders, Aram et al. (1984) found that 75% of a group of 20 children initially examined as preschoolers

continued to have academic difficulties, especially associated with language-learning deficits. In another longitudinal study of children initially assessed with specific language impairment between 4 years 6 months and 8 years, Stark et al. (1984) found 80% of the children continued to be language impaired 4 years later, with 90% of the children with language impairment demonstrating reading deficits. Lewis and Freebairn (1992) found that preschool children who had phonological deficits along with language deficits, had difficulty with reading at school age, and showed particular deficits in rapidly sequencing syllables, producing difficult phoneme combinations, and producing novel sound sequences.

Late Talkers

Some children are late to talk and may be at risk for later language impairment. Rescorla (1991) reported that 1-15% of middle class toddlers fail to achieve 50 words by 24 months. Clearly not all these children will be chronically delayed, however some will. The difficulty is determining which children with SELD are at risk for chronic delay. Rescorla's (1991) Language Development Survey (LDS) has been developed to identify toddlers at risk for chronic delay. It has high reliability, validity, 90% specificity (accuracy in identifying normals as normal), and 90% sensitivity (accuracy in identifying those with deficits as impaired). The LDS includes a parent checklist of 300 of the most common words in children's early vocabularies, and was used by Paul (1993) to identify children as late talkers for the Portland Language Development Project.

Whitehurst, Fischel, Lonigan, Valdez-Menchaca, Arnold and Smith (1991)

described children who are late talkers as having "a substantial delay in the development of spoken language compared with receptive language and nonverbal intelligence" (p.56). According to research conducted by Whitehurst et al. (1991), children who are late to talk may outgrow their deficit. In their study, only a small group of children continued to have language deficits at 5 to 6 years of age.

Other studies have followed toddlers with late expressive language through their preschool and kindergarten years. In a follow-up study of 25 3-and 4-year-old boys originally diagnosed with SELD between 24 and 31 months, Rescorla and Schwartz (1990) found that half the subjects caught up, while the remainder continued to show problems. Paul (1993) found that 59% of toddlers with a history of late talking had expressive syntax deficits at the age of 3 years, and 47% had expressive syntax delays at the age of 4 years. In a follow-up study of kindergartners, Paul et al. (1992) found that children identified as SELD at 2 years caught up with normal peers on measures of receptive language, motor skills, nonverbal intelligence, and daily living. While they were within the normal range in expressive language ability and reading readiness, they were still significantly lower than peers in most expressive language skills, and in reading readiness. Bishop and Adams (1990) studied a group of 83 children who had language impairments at age 4. Of this group, 32 had "outgrown" their language delay by age 5 years 6 months, showing no evidence of literacy delay.

In one of the few studies that explored the relationship between early expressive delays in toddlers and later abilities to engage in the literacy demands of school, Scarborough and Dobrich (1990) followed 4 children with early language delays from the

age of 2 years 6 months to 8 years. The 4 children showed nearly normal speech and language development by the age of 5. However, in second grade, 3 of the 4 children had severe reading deficits.

Reading and Phonological Processing

Although reading is a language-based activity dependent on oral language skill, it requires additional metalinguistic skills to decode, break down words, and associate sounds with letters. Phonological processing is thought to play a major role in reading achievement. A longitudinal study conducted by Torgesen, Wagner, and Rashotte (1994) found a causal link between various measures of phonological processing (i.e., phonological awareness, phonological encoding, and phonological retrieval) and continued growth in reading ability. Recent research has focused on three aspects of phonological processing: (a) phonological encoding and retrieval, (b) phonological awareness, and (c) phonological production (Catts, 1989; Swank, 1994).

Phonological Encoding and Retrieval

Phonological encoding refers to the ability to process speech by encoding the phonemic structure. The phonological structure has to be identified perceptually, and then the phonological structure is encoded and stored into long term memory (Catts, 1989). Brady, Shankweiler, and Mann (1983) studied speech perception (monosyllabic real words) and non-speech perception (environmental sounds) of good and poor readers. To study speech perception, monosyllabic real words were presented to good and poor readers, in both masked and unmasked conditions. The poor readers made significantly

more errors than good readers in identifying speech stimuli in the masked condition. To study non-speech perception, environmental sounds such as (a) knocking on a door, (b) running water from a faucet, and (c) dialing a phone were presented, in masked and unmasked conditions. There was no significant difference in perception of non-speech environmental sounds between the groups of good and poor readers. The results of this study show that the poor readers had a perceptual problem processing speech, that could be due to an encoding difficulty, and that they did not have a general auditory perceptual problem.

Swank (1994) suggested that children with reading problems may have inordinate difficulty discriminating among phonemes, which may make it difficult for children to understand grapheme-phoneme relationships, and will affect the encoding of phonemes. As an example, she suggested short vowels /ɛ/, /æ/, and /I/ may all be encoded as the same vowel. Voiced and voiceless contrasts may not be distinguished, so cognates are encoded as the same phoneme.

Phonological retrieval is related to phonological encoding. Children with an incomplete phonological representation may have difficulty retrieving phonological information from memory. Deficits in phonological retrieval are evidenced by problems with confrontational and rapid automized naming (Swank, 1994). Research indicates that children with such naming problems also have reading deficits. In their studies, Felton and Wood (1989) found that poor readers had significantly lower scores on confrontational and rapid automized naming tasks.

Based on his study, Catts (1986) theorized that both encoding and retrieval

problems play a role in production difficulties. Children in this study completed three tasks demonstrating their ability to produce multisyllabic words and phonologically complex phrases. Rather than considering their errors as errors of production, Catts theorized that they were encoding deficits because the omissions and substitutions were not consistent across words, but were word specific. Retrieval deficits were evidenced by difficulty in the naming task that required the children to name pictures.

Phonological Awareness

Phonological awareness refers to the conscious ability to manipulate phonemes in spoken language. Developing this awareness is a gradual process. Children first recognize boundaries between words, and then recognize the common sound segments shared by those words with other words (Catts, 1989). Later, children will be able to distinguish syllables, and still later will be able to segment words phonetically (Liberman & Shankweiler, 1985). Phonological awareness will enable children to make the connection between letters and sounds, and enable them to "break the code" (Blachman, 1987). The inability to decode means that cognitive faculties must be used for word recognition rather than comprehension (Blachman, 1987).

There are a number of studies supporting the relationship of phonological awareness and the ability to read. Bradley and Bryant's study (1983) examined phonological segmenting abilities of 4-and 5-year-olds, and found these were significantly correlated with later reading achievement. Four measures of phonological awareness and their potential to predict first grade decoding abilities were examined by Swank and Catts (1994). They found a significant relationship between phonological

awareness tasks and later reading outcomes. The phonological awareness demonstrated by kindergartners' ability to count syllables of speech was found to be related to first grade reading outcomes by Mann and Liberman (1984).

Ball and Blachman (1988) evaluated the relationship of phoneme segmentation to reading by conducting a study of non-reading kindergartners. The children were divided into three groups for analysis. The first received phoneme segmentation instruction, the second received language enrichment, and the third received no intervention. The group instructed on phonemic segmentation was significantly superior in both reading abilities, and segmenting abilities, compared to the other two groups. Two studies by Vellutino and Scanlon (1987): (a) a longitudinal study of kindergartners at the end of first and second grades, and (b) a study of second and sixth graders who were poor and normal readers, demonstrated a causal link between phoneme segmentation and reading ability. A study of third grade children and adults by Pratt and Brady (1988) also showed a correlation between phonological awareness and reading ability.

Phonological Production

Production of complex phonological sequences is difficult for poor readers (Catts, 1986). Especially difficult are multisyllabic words. Catts (1986) also found that a phrase repetition task, using less difficult words, but words with similar sounds, was difficult. Swank (1994) suggested two explanations for difficulties with phonological production. The first is a motor-speech planning deficit. During production of multisyllabic words in Catts' 1986 study, an analysis of type of errors produced showed errors of assimilation, an indication of speech-motor programming errors. While the

subjects had difficulty producing complex multisyllabic words, they did attempt to self-correct. According to Catts (1986), the self-correcting attempt indicates that their phonological memory was superior to their actual outputting capabilities.

The second explanation Swank (1994) offered for production deficits is related to phonological encoding deficits. A study by Kamhi, Catts, and Mauer (1990) consisted of four tasks: exposure, comprehension, production, and recognition. In this study, children were exposed to and trained to produce nonsense words. A comparison of normal and poor readers showed the poor readers were significantly poorer in the recognition task. Since production was not required for recognition, this was considered an encoding deficit rather than an output deficit.

It may be difficult to separate encoding and production, because encoding deficits obviously influence production. Swank (1994) suggested motor-speech planning deficits may interfere with multisyllabic production, while encoding deficits may make production of "low-frequency" words difficult.

Summary

Research indicates that children identified as late talkers as toddlers continue to have difficulties with expressive language in the preschool and kindergarten period. There is also evidence that children with language impairment during preschool and kindergarten may be at risk for academic achievement deficits, especially in reading. Because reading requires metalinguistic skills, children with phonological processing deficits may be especially at risk for reading disabilities.

Most existing research has focused on the continued delays of toddlers with SELD and continued impairments for preschoolers with language disabilities. There is limited research regarding the reading achievement of children who were late talkers as toddlers. This study will focus on second grade children who were identified as SELD as toddlers. The study will describe their achievement in reading and phonological processing, and correlate the two.

CHAPTER III

METHODS AND PROCEDURES

Subjects

Subject Recruitment

This study is part of the Portland Language Development Project, a longitudinal examination of the characteristics of late talkers. (See Appendix A for Human Subject Approval.) The data were collected by graduate students in speech-language pathology, between 1987 and 1992. This researcher did not participate in data collection. Subjects were recruited in one of three ways: (a) by questionnaires at three Portland medical clinics (see Appendix B), (b) through a newspaper article in the Oregonian, and (c) through radio ads.

The questionnaires were distributed to parents of children, during well baby checkups. The questionnaire asked for information about the expressive vocabulary size of the toddlers and asked parents about their willingness to participate in a study. An advertisement for speech delayed children was also published in an article in the Oregonian, a local paper. An additional advertisement was broadcast by a local radio station.

Subject Description Age Two

The children recruited from the above sources were seen at 20-34 months. Thirty-two children with less than 50 expressive words, and no two-word phrases by parent report on the Language Development Survey (LDS) (Rescorla, 1989) were

assigned to the SELD group. The LDS contains a checklist of 300 of the most common words in children's early vocabulary, and has a high degree of reliability, validity, sensitivity, and specificity for identifying language delay in toddlers. A group of 27 children whose parents reported more than 50 expressive words, and the use of two-word phrases on the LDS was matched to the SELD group on the basis of age, social-economic status, and sex ratio for a normal control group. All the children included in the study passed a hearing screening at 25 dB, and scored above 85 on the Mental Development Index (MDI) of The Bayley Scale of Infant Mental Development (Bayley, 1969), and passed observational screening for neurological disorders and autism.

Table 1 shows the demographic information of the diagnostic groups upon intake. The table includes the number of subjects, and the mean and standard deviation for age, socioeconomic status, and number of words.

Table 1

Group Demographic Information at Intake

Group	n	Intake age [a]		SES [b]		# Words on LDS	
		Mean	SD	Mean	SD	Mean	SD
Normal	27	26.1	3.82	3.41	1.03	203.78	68.92
SELD	32	25.41	3.43	3.56	0.75	29	24

[a] age in months

[b] using Hollingshead's (1975) four factor scale of social position, on a scale from 1 to 5, where 1 is the lowest and 5 is the highest SES rating.

Subject Group Assignment at Second Grade

The subjects were seen for reevaluation during their second grade year. A spontaneous speech sample was collected and the Developmental Sentence Score (DSS) (Lee, 1974) was used to evaluate the samples. This researcher divided the subjects into the following three groups (see Appendix C) on the basis of their DSS scores, and the initial intake placements:

1. Twenty-seven children who used at least 50 expressive words and two-word phrases at age 20-34 months, and scored above the 10th percentile (a score of 8.11) on the DSS (Lee, 1974), comprised the normal group (NL).

2. Twenty-seven children who had an expressive vocabulary of less than 50 words at age 20-34 months, and scored above the 10th percentile (a score of 8.11) on the DSS (Lee, 1974) in second grade, comprised the history of language delay (HX) group.

3. Five children who had an expressive vocabulary of less than 50 words at age 20-34 months, and who scored below the 10th percentile (a score of 8.11) on the DSS (Lee, 1974) in second grade, comprised the chronically language delayed (ELD) group. Table 2 shows the demographic information of the diagnostic groups upon second grade evaluation. The table includes the number of subjects, gender, ethnicity, the mean age, standard deviation for age, DSS score, and socioeconomic status.

Instrumentation

Audiotaping

The spontaneous language samples were audiotaped using a Sony

Table 2

Group Demographic Information at Second Grade

Group	n	Second grade age [a]		SES [b]		DSS	
		Mean	SD	Mean	SD	Mean	SD
Normal	27	96.55	2.06	3.41	1.03	10.54	1.84
HX	27	96.18	2.79	3.67	0.77	10.10	1.28
ELD	5	95.8	1.17	3.0	0	7.05	.32

[a] age in months
[b] using Hollingshead's (1975) four factor scale of social position, on a scale from 1 to 5, where 1 is the lowest and 5 is the highest SES rating.

Dictator/Transcriber BM-88, a Sony ECM-144 Electret Lavalier condenser microphone, and Sony DC-30 cassette tapes.

The Developmental Sentence Score

The DSS (Lee, 1974) is used to score the syntactic complexity of the utterances based on eight grammatical categories: indefinite pronouns, personal pronouns, main verbs, secondary verbs, negatives, conjunctions, interrogative reversals, and Wh questions. Points are assigned to each utterance based on the complexity of the syntactic structures, and on the number of syntactic structures used. If the sentence is syntactically correct by adult standards, a sentence point is awarded. The points for all 50 sentences are then added together, and divided by 50 to produce a DSS score. The score is then compared to percentile ranks provided in the manual. A second grade child at the 50th percentile will receive a score of 10.94. Table 2 shows the NL and HX groups were

close to the 50th percentile in their DSS scores, with scores of 10.54 and 10.10 respectively.

The DSS is a normed reference instrument, developed by Lee (1974) as a valid and reliable means to evaluate the syntactical speech samples of children. It was standardized on 200 Caucasian children aged 2 to 6:11. There were 5 male and 5 female children for each 3-month interval of age. The subjects lived in homes in which standard American English was spoken, in the states of Illinois, Maryland, Michigan, and Kansas. All but 3 came from middle class families. The internal consistency is .71. The split-half reliability is .73. Assessing interjudge reliability by using the scoring of two different judges showed no significant differences.

The Peabody Individual Achievement Test

The Reading Recognition and Reading Comprehension subtests of the Peabody Individual Achievement Test (PIAT) (Dunn & Mackwardt, 1970) were used in this study as a standardized screening measure of reading achievement in children. The PIAT was standardized on 2,889 children attending regular education classes in nine geographical regions, including three community types: urban, suburban, and rural. There were 200 children for each grade level, 1-12, and 159 kindergartners. Approximately half of the children were male, and half were female. Eighty-four percent were Caucasian, 11.3% were African American, and 4.3% were other. Grade equivalent, age equivalent, percentile ranks, and standard scores are provided along with standard error of measurement for each grade level. Content validity was established through an extensive review of curriculum material at each grade level. Internal consistency was maintained

by selecting items that correlated most closely to the total score on the subtest. Test-retest reliability showed the reading recognition to be 89% reliable, and the reading comprehension to be 64% reliable.

The Lindamood Auditory Conceptualization Test

The Lindamood Auditory Conceptualization Test (LAC) (Lindamood & Lindamood, 1979) is a standardized test designed to assess the ability to discriminate phonemes presented in isolation and to assess ability to segment words. It was standardized on 660 children grades K-12 attending Monterey Peninsula United Schools in Monterey, California. A random selection procedure was used to ensure selecting an equal number of boys and girls, and an equal number of high and low achievers at each grade level. Alternate form reliability is reported at .96. Predictive validity was determined by correlating the total score with the combined Reading and Spelling Scores from the Wide Range Achievement Test (WRAT) (Jastak & Jastak, 1978). The correlation ranged from .66 to .81 for different grade levels. A phonological segmenting deficit is identified by a score below the cut-off score of 61 on the Lindamood taken during the first half of second grade.

Complex Phonological Production Tasks

The complex phonological production tasks were developed by Catts (1986) and adapted by Paul (1995). In his study, Catts (1986) found that the children who were reading disordered made significantly more errors than the typically developing children in all three production tasks: naming, word repetition, and phrase repetition. There were 20 items for both the naming and word repetition tasks, and 45 words in the phrase

repetition task (see Appendix D). The scores were calculated by scoring one point for each correct answer. This is a non-standardized measure. An error rate of more than 20% is considered an indication of higher-level phonological difficulties.

Procedures

At the second grade evaluation, a spontaneous speech sample was recorded on audio tape while a trained speech-language pathology graduate student interviewed the children individually, following Evans and Craig's procedure (1992). The children were asked about their families, what they liked to play, and what they liked about school. The sample was transcribed by a trained speech-language pathology graduate student, by means of the Systematic Analysis of Language Transcripts (SALT) computer program (Miller & Chapman, 1985). The DSS (Lee, 1974) was used to evaluate the language sample produced by each child. Fifty utterances, each including a subject and predicate, were scored for each child, according to the rules for DSS (Lee, 1974).

The entire Peabody Individual Achievement Test (PIAT) (Dunn & Mackwardt, 1970) was administered individually to each child. The Reading Recognition and Reading Comprehension subtests of the PIAT were the only subtests used in this study. There are three parts to the Reading Recognition subtest. First, the child was asked to identify a letter or word by pointing to (or naming) one of four choices. Next, the child was asked to point to (or name) which letter out of four choices had the same sound as the prompt presented by the examiner. Last, the child read orally. For the Reading Comprehension subtest, the child read a sentence silently and then pointed to the picture

that represented the sentence meaning.

Complex phonological production skills were assessed by using a non-standardized procedure developed by Catts (1986) and adapted by Paul (1995). Three tasks were included: a naming task, a word repetition task, and a phrase repetition task (see Appendix D). The three tasks were administered individually to each child by trained speech-language pathology graduate students. For the naming task, the child named pictures representing multisyllabic items, such as *alligators*, and *stethoscope*. These pictures included labels that the children could read if there was any confusion about the pictured item. For the word repetition task, the child repeated multisyllabic words such as *peculiar* and *Colorado*. For the phrase repetition task the child repeated short difficult phrases (tongue-twisters) with monosyllabic and bisyllabic words such as *fly free in the Air Force* and a *box of mixed biscuits*.

Phonological awareness was assessed by using the Lindamood Auditory Conceptualization Test (LAC) (Lindamood & Lindamood, 1979), that was administered individually to each child. There are two subtests for the LAC. In the first subtest, the child manipulated colored blocks, with each color representing a different sound, to show comprehension of the number of sounds presented, and to indicate whether sounds presented were the same or different. For the second subtest, the child used colored blocks to create sequences representing sounds of pseudowords pronounced by the trained graduate students to assess the ability to segment and reorder sounds and the symbols representing them.

Reliability

Reliability measures were performed by speech-language pathology graduate students trained for the Portland Language Development Project. Language samples were randomly selected and scored by a second graduate student. Eleven percent of the samples were analyzed for word-by-word agreement on the transcriptions, with 94% accuracy. Eight percent of the samples were analyzed for sentence choice reliability, to evaluate noun-verb phrases used for DSS analysis. This analysis indicated 90% agreement. Fourteen percent of the samples were analyzed for point-by-point reliability in assigning DSS scores, with 92% agreement. Fourteen percent of the PIAT tests were scored concurrently by two speech-language pathology graduate students at the time of administration. Comparing the test scores showed interjudge reliability to be 99%. Two speech-language pathology graduate students concurrently scored 14% of the phonological production tasks, with interjudge reliability of 97%.

Research Design One

Research Design

This is a complex group study, which includes the independent variable of language diagnosis with three levels: normal (NL), language delayed (HX), and chronic language delay (ELD). There are six dependent variables. These are (a) the Reading Recognition subtest score from the PIAT, (b) the Reading Comprehension subtest score from the PIAT, (c) the LAC score as a measure of phonological awareness, (d) the phonological production naming task score, (e) the word repetition task score, and (f) the

phrase repetition task score.

Data Analysis

A group mean, standard deviation, and range for each dependent variable was established for each of the three subject groups (NL, HX, and ELD). The Kruskal-Wallis, a nonparametric measurement of variance, was used to determine if there are significant differences among the three groups of second graders with different language histories: normal, delayed, and chronic language delayed, in terms of their phonological and reading abilities. The Mann-Whitney U was used as a post-hoc measure to further examine any differences found.

Research Design Two

This study was a correlational study in which reading scores and phonological scores were correlated. The correlations were examined by using a regression analysis to determine if reading recognition and reading comprehension can be predicted from the phonological naming task score, phonological word repetition task score, phonological phrase repetition task score, or the LAC score, an indication of phonological awareness.

CHAPTER IV

RESULTS AND DISCUSSION

Results

There were two purposes of this study. The first purpose was to determine if there were significant differences in reading skills and phonological processing abilities among three groups of second grade children: those with normal language development (NL); those with a history of SELD as preschoolers, but currently normal expressive language (HX); and those with a history of SELD with continued expressive delay (ELD). The second purpose was to determine if there were significant correlations among complex phonological production and phonological awareness skills, and reading abilities among a group of second graders, identified as SELD at the age of 2 years.

To examine phonological production, three measures were used: a naming task, word repetition task, and a phrase repetition task. Phonological awareness was examined by using the Lindamood Auditory Conceptualization Test (LAC). Reading ability was examined by using the Reading Recognition and Reading Comprehension subtests of the Peabody Individual Achievement Test (PIAT). The mean, standard deviation, and range for each of these dependent measures examined have been calculated for each language group. These are shown in Table 3.

In the study, research question one, two, and three examined whether there were significant differences in (a) phonological production skills, measured by a naming task, word repetition task, and phrase repetition task, (b) phonological awareness, measured by the Lindamood Auditory Conceptualization Test (LAC), and (c) reading abilities

Table 3

Mean, Standard Deviation and Range for Dependent Measures

Measure	Group	Mean	SD	Range
Lindamood	Normal	75.33	17.6	42-100
Auditory	HX	71.18	16.93	42-100
Conceptualization	ELD	49.40	18.38	19-64
Naming	Normal	93.74	2.82	85-96
Pictures	HX	90.81	4.10	83-96
	ELD	91.80	2.99	86-94
Word	Normal	83.33	3.35	74-87
Repetition	HX	81.67	4.08	69-87
	ELD	80.40	3.61	74-85
Phrase	Normal	40.07	3.46	27-44
Repetition	HX	38.85	3.80	28-44
	ELD	38.40	4.59	30-43
Reading	Normal	114.44	14.54	78-135
Recognition	HX	112.30	16.79	83-135
	ELD	100.80	21.29	74-128
Reading	Normal	113.96	12.44	86-135
Comprehension	HX	108.11	14.19	65-135
	ELD	103.06	11.79	83-117

measured by the Reading Recognition and Reading Comprehension subtests of the Peabody Individual Achievement Test (PIAT). (Appendix E shows the actual scores for each subject.) The Kruskal-Wallis, a non-parametric measure of variance, was used to determine if there were any significant differences in the group scores. Statistical significance was established at an alpha level of .05. Results of the Kruskal-Wallis, including name of measure, chi-square, degrees of freedom and p value are shown on Table 4.

Table 4

Kruskal-Wallis 1-Way Analysis of Variance

	Corrected for Ties		
Measure	Chi-Square	DF	P
LAC [a]	5.772	2	.056
Naming Pictures	8.429	2	.015
Word Repetition	4.491	2	.106
Phrase Repetition	1.202	2	.548
Reading Recognition	1.267	2	.531
Reading Comprehension	3.804	2	.149

[a] LAC=Lindamood Auditory Conceptualization Test

A significant difference in the naming task was indicated by the Kruskal-Wallis, with a p value of .015. The Kruskal-Wallis also indicated a borderline significant difference in the LAC, with a p value of .056. The Mann Whitney U post-hoc test was used to further examine differences of both the naming task and the LAC. The results for

the naming task, including the comparison made, U value, W value, Z value, and 2-tailed p value are shown on Table 5.

Table 5

Mann-Whitney U for Naming Task

			Corrected for Ties	
Comparison	U	W	Z	2-Tailed p
NL vs. HX	210.0	897.0	-2.701	.007
NL vs. ELD	33.0	48.0	-1.826	.068
HX vs. ELD	63.0	87.0	-0.235	.814

The Mann-Whitney U showed a significant difference between the NL group and the HX group for the naming task, with a p value of .007. There was a borderline significant difference between the NL group and the ELD group with a p value of .068. There was no significant difference between the HX group and the ELD group.

The Mann-Whitney U results for the LAC are shown in Table 6. The results for the LAC include comparison made, U value, W value, Z value, and 2-tailed p value. The Mann-Whitney U examination of the LAC showed there was a significant difference between the NL group and the ELD group, with a p value of .028, and a significant difference between the HX group and the ELD group, with a p value of .040. There was no significant difference between the NL group and the HX group.

Research questions four and five examined whether there were significant correlations among: (a) complex phonological production skills, as measured by the

Table 6

Mann-Whitney U for LAC

Comparison	U	W	Corrected for Ties	
			Z	2-Tailed p
NL vs. HX	308.5	798.5	-0.972	.331
NL vs. ELD	25.5	40.5	-2.190	.028
HX vs. ELD	28.0	43.0	-2.052	.040

naming task, word repetition task, and the phrase repetition task, (b) phonological awareness as measured by the LAC, and (c) reading ability as measured by the Reading Recognition and Reading Comprehension subtests of the PIAT.

A correlation matrix with reading recognition as the dependent variable is shown in Table 7. The matrix shows the LAC as having the strongest correlation with reading recognition, compared to the other independent variables of naming pictures, word repetition, and phrase repetition. The matrix also shows a high degree of collinearity, meaning the same construct is being measured, for the tasks of word repetition and naming, and for phrase repetition and word repetition.

A stepwise regression analysis with reading recognition as the dependent variable is shown in Table 8. This further analysis of the data shows that only one variable, the LAC, contributed a discernable influence over reading recognition. The R squared value shows the LAC was able to predict 39% of the Reading Recognition score, with a significant F value of less than .0006.

Table 7

Regression with Reading Recognition as Dependent Variable

	Reading Recognition	Naming	Repetition	Phrases	LAC [a]
Reading Recognition	1.000				
Naming Pictures	.404	1.000			
Word Repetition	.469	.733	1.000		
Phrase Repetition	.308	.521	.719	1.000	
LAC [a]	.627	.361	.397	.464	1.000

[a] LAC=Lindamood Auditory Conceptualization Test

Table 8

Multiple Regression with Reading Recognition as the Dependent Variable

Step	MultR	Rsq	F(Eqn)	SigF	Variable
1	.6271	.3932	19.441	.000	LAC [a]

[a] LAC=Lindamood Auditory Conceptualization Test

A correlation matrix with reading comprehension as the dependent variable is shown in Table 9. This matrix shows the LAC as having the strongest correlation reading comprehension, compared to the other independent variables of naming pictures, word repetition, and phrase repetition. The matrix also shows a high degree of

collinearity, meaning the same construct is being measured, for the tasks of word repetition and naming, and for phrase repetition and word repetition.

Table 9

Regression with Reading Comprehension as Dependent Variable

	Reading Comprehension	Naming	Repetition	Phrases	LAC [a]
Reading Comprehension	1.000				
Naming Pictures	.406	1.000			
Word Repetition	.307	.733	1.000		
Phrase Repetition	.257	.521	.719	1.000	
LAC [a]	.517	.361	.397	.464	1.000

[a] LAC=Lindamood Auditory Conceptualization Test

A stepwise regression analysis with reading comprehension as the dependent variable is shown in Table 10. This stepwise analysis shows that only one variable, the LAC, contributed an observable influence over reading comprehension. The R squared value showed the LAC was able to predict 27% of the reading recognition score, with a significant F value of .002.

Table 10

Multiple Regression with Reading Comprehension as the Dependent Variable

Step	MultR	Rsq	F(Eqn)	SigF	Variable
1	.5169	.2672	10.939	.002	LAC [a]

[a] LAC=Lindamood Auditory Conceptualization Test

Discussion

One purpose of this study was to determine if there were significant differences among three groups of second graders with different language histories: NL, HX, and ELD, based on measures of complex phonological production, phonological awareness, and reading. The data showed that there was a significant difference between the NL group and the HX group in the naming task, one of the complex phonological production tasks. This suggests that while the HX group appears to have outgrown their expressive language delay, they are still significantly different from their peers with a history of normal language development (NL) in the ability to produce words that are phonologically complex. The inability to produce these phonologically demanding words may indicate a difficulty with phonological processing. This deficiency may by the result of an encoding problem, or a retrieval problem. Whether due to encoding or retrieval, this impairment may affect literacy skills. In his study, Catts (1986) found children with reading disabilities to be significantly poorer than children with normal reading ability, in the ability to produce phonologically demanding words and phrases.

While there was a significant difference between the NL group and the HX group,

there were no significant difference between the NL group and the ELD group. If the HX group is significantly different from the NL group, it might be expected that the ELD group which continues to show evidence of an expressive language delay would be significantly different as well. When the mean of the ELD group is compared to that of the NL group (see Table 3), the mean of the ELD group is lower than that of the NL group. When the NL group and the ELD group were compared by the Mann-Whitney U, the p value of .068 shows that the difference did approach significance. It may be that if the sample size of the ELD group (n=5) was larger, a significant difference between the NL group and the ELD group could be detected.

The data also show significant differences between the groups on the LAC, used to examine phonological awareness. There were significant differences between the NL group and the ELD group, and between the HX group and the ELD group. This suggests phonological awareness may be especially difficult for children continuing to suffer from expressive language delay. This is similar to findings in a study by Kamhi, Lee, and Nelson (1985). In their study comparing children with language disorder to children with normally developing language, they found the children with language disorder were significantly poorer in tasks of word, syllable, and sound awareness.

Considering the large number of studies demonstrating a relationship between phonological awareness and reading, (Ball & Blachman, 1988; Bradley & Bryant, 1983; Mann & Liberman, 1984; Pratt & Bradley, 1988; Swank & Catts, 1994; Vellutino & Scanlon, 1987) it is surprising that there were no significant differences in reading recognition or reading comprehension among the three groups. It might be expected that

the ELD group, having shown a significant difference in phonological awareness compared to their NL and HX peers, would also demonstrate a significant difference in reading ability. Instead, the data suggest both groups of children, (HX and ELD) identified as SELD at 2 years of age, did not perform significantly differently from their NL peers in reading tests. Studies mentioned previously by Butler (1988) and Catts (1993) found that children with oral expressive language deficits at kindergarten were at greater risk for reading disabilities. However, the ELD group in this study does not demonstrate any significant reading difference compared to their NL or HX peers. The results of this study may have been affected by the small sample size (n=5) of the ELD group. It is possible that these 5 subjects are not representative of the group of children who continue to have expressive language delays as second graders. While there is not a significant difference between the ELD group and the NL group, at least some of the ELD children had difficulty with the Reading Recognition subtest, as evidenced by the large standard deviation.

The second purpose of this study was to examine the correlation between complex phonological production and phonological awareness, and reading among a group of second grade children who were identified as SELD at the age of 2. The data showed correlations between the word repetition task and the naming task, the word repetition task and the phrase repetition task, and the naming task and phrase repetition task. These are all measures of complex phonological production, and it is not surprising that correlations existed. The primary interest in this study is the relationship of the measures of complex phonological production and phonological awareness with reading.

The stepwise regression analysis showed that the LAC, used as a measure of phonological awareness, was the only variable that correlated with reading for these children. There was no correlation among any of the measures of complex phonological production and reading scores on the two subtests of the PIAT. The data showed phonological awareness as measured by the LAC accounted for a significant portion of the variance (r^2 =.39) of the reading recognition subtest score. Similar results were evident in a study by Swank & Catts (1994), in which a phonological awareness deletion task accounted for .34 of the variance in word attack and word identification tasks. Although the data showed the LAC to account for a smaller percentage of the reading comprehension score (27%), this is still a significant contribution.

CHAPTER V

SUMMARY AND IMPLICATIONS

Summary

Phonological processing skills are known to be related to reading ability (Blachman, 1989). Moreover, higher-level language skills, including phonological awareness, are known to be impaired in children with language-learning disabilities (Kamhi, Lee, & Nelson, 1985; Roth & Spekman, 1989). This study was concerned with the outcomes of higher-level language and literacy skills in children with early delays in the development of language.

There were two purposes of this study. The first was to examine reading skills and phonological processing abilities of second grade children with different language histories: those with normal language development (NL); those with a history of slow expressive language development (SELD) as toddlers, but currently normal expressive language (HX); and those with a history of SELD who continue to perform below the normal range in expressive language (ELD).

Significant differences were found on the complex phonological task of naming pictures between the NL group and the HX group. Significant differences were also found on the LAC, used as a measure of phonological awareness, between the NL group and the ELD group, and between the HX group and the ELD group.

The second purpose was to determine if there were significant correlations among phonological production, phonological awareness skills, and reading abilities among a

group of second graders identified as SELD at the age of 2 years. The LAC was the only variable that correlated with the Reading Recognition or Reading Comprehension subtests. The LAC accounted for a significant portion of variance (39%) of the Reading Recognition score, and 27% of the variance of the Reading Comprehension score.

Implications

Research Implications

This study showed no significant differences in reading among the three groups, but showed some significant differences in complex phonological processing. Further research examining a larger sample size might help clarify the role complex phonological production and phonological awareness play in reading abilities among children with a history of SELD.

It is possible that the children identified as SELD at the age of 2 may appear to have "caught up" with typically developing children by second grade, but may show signs of a lag after the NL children have had the "second spurt of language growth" referred to by Scarborough and Dobrich (1990). As the second grade students continue through later grades, the change in curriculum places even more demands on reading. Studying the reading achievement in later grades would provide information about later reading problems that might appear. Because of the relationship of reading to academic success, there is a need for further research to determine if children with SELD as toddlers continue to have deficits that affect higher order language skills like reading, and to determine what kinds of early intervention treatment programs are most successful

in treating any residual deficits found. This research will help make it possible for children with early language delays to be successful in meeting the academic demands of school.

Further research could focus on other variables besides phonological production and awareness that might make a difference in reading. Catts (1993) found a correlation between phonological awareness and rapid naming, and word recognition, but found semantic-syntactic abilities correlated with reading comprehension.

Clinical Implications

This study showed a strong correlation between reading recognition as measured by the PIAT, and phonological awareness as measured by the LAC, for children with a history of SELD at the age of 2. There was a weaker, but still significant correlation between reading comprehension and phonological awareness. The ELD children were significantly poorer in the measure of phonological awareness compared to their HX and NL peers. The HX children were significantly poorer in the performance of picture naming, a complex phonological production task, compared to the NL group. Because of the correlation between phonological awareness and reading, and because of the deficits of the HX group and the ELD group in two measures of complex phonological processing abilities, children with a history of SELD as 2-year-olds may particularly benefit from early intervention that includes instruction in phonological processing, especially phonological awareness.

A study by Lundberg (1988) showed it was possible to teach phonological awareness to preliterate preschool children. Bradley and Bryant (1983) trained a group

of children in categorizing sounds and found that group to be significantly better readers by the end of the study than a group who were taught to semantically categorize, and a group with no instruction.

Because of the small sample size, especially of the ELD group, further research would be required to determine if the results of this study would apply to other children with a history of SELD as toddlers. Further, it should be noted that the children in this study were primarily from a middle class socioeconomic group, so results would generalize only to other middle class children.

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APPENDIX A

HUMAN SUBJECTS RESEARCH FORM

OFFICE OF GRADUATE STUDIES AND RESEARCH
Research and Sponsored Projects

DATE: May 7th 1995

TO: Candace Murray

FROM: for Laurie Skokan, Chair, HSRRC, 1994-95

RE: HSRRC Waived Review of Your Application titled "Reading Abilities and Phonological Skills of Second Grade Children with Three Different Language Development Histories: Normal, Delayed, and Chronically Delayed"

Your proposal is exempt from further HSRRC review, and you may proceed with the study.

Even with the exemption above, it was necessary by University policy for you to notify this Committee of the Proposed research and we appreciate your timely attention to this matter. If you make changes in your research protocol, the Committee must be notified. This approval is valid for one year from date of issue.

c: Maureen Orr Eldred
Rhea Paul, Project Advisor

waiver.mem

APPENDIX B

QUESTIONNAIRE FOR PARENTS OF

CHILDREN 15-30 MONTHS OLD

QUESTIONNAIRE FOR PARENTS OF CHILDREN 15-30 MONTHS OLD

What is your child's:

first name?_____date of birth? _____

Mother's (or primary parent's) full name?_____

Mother's (or primary parent's) phone number_____

Mother's occupation_____

Father's occupation_____

How many different words can your child say? (It's OK if the words aren't entirely clear, as long as you can understand them.)

none_____ 5-10_____ 30-50_____
less than 5_____ 10-30_____ More than 50_____

If your child says fewer than ten words, please list than here:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Does your child put words together to form short "sentences"?
Yes_____ No_____
If yes please give three examples here:

_____

_____

_____

Would you be interested in participating in later parts of this study?
Yes_____ No_____

APPENDIX C

SUBJECT IDENTIFICATION

AT SECOND GRADE

Table C1

Normal Group

Subject #	Age [a]	DSS	Sex	SES [b]	Ethnicity [c]
004	94	10.02	M	3	3
009	93	12.06	M	3	3
014	98	8.16	M	5	1
027	99	8.88	M	3	1
036	98	8.20	F	4	1
040	96	8.82	F	2	1
051	93	11.08	F	3	1
055	97	10.66	F	3	1
058	97	13.24	M	4	1
059	102	10.04	F	1	1
063	97	11.88	F	4	1
072	95	10.00	F	3	1
081	97	8.98	F	2	1
095	96	9.46	M	3	1
113	94	9.14	F	4	1
126	99	11.04	F	4	1
128	96	8.68	M	4	1
129	99	8.18	M	2	1
130	95	15.74	M	4	1
131	97	10.46	M	4	1
132	97	11.31	M	5	3
133	96	10.04	M	3	1
138	100	11.46	M	4	1
139	96	14.82	F	3	1
141	95	11.04	M	5	1
144	96	10.46	M	2	1
150	95	10.70	F	5	1

[a] age in months

[b] using Hollingshead's (1975) four factor scale of social position, on a scale from 1 to 5, where 1 is the lowest and 5 is the highest SES rating.

[c] 1=white, 2=black, 3=other

Table C2

HX Group

Subject #	Age [a]	DSS	Sex	SES [b]	Ethnicity [c]
006	96	10.98	M	4	1
007	96	10.26	M	4	1
012	95	8.52	M	5	1
029	98	9.40	F	5	1
039	94	11.22	M	4	1
041	93	9.56	M	3	1
057	94	9.94	F	2	1
084	92	10.06	M	4	1
085	95	10.08	M	3	1
086	98	8.22	M	4	1
087	95	8.66	M	3	1
090	103	13.98	M	3	1
091	99	8.60	M	4	1
092	94	12.24	M	3	1
094	99	9.88	M	3	1
098	98	8.84	M	4	1
100	96	11.96	M	5	1
102	98	9.84	M	4	1
103	94	10.54	M	4	1
105	95	10.24	M	2	1
107	100	9.90	M	4	1
109	92	9.14	M	3	1
111	95	9.84	F	3	1
114	99	12.04	M	4	3
119	101	10.14	M	4	1
122	92	9.46	F	4	2
142	96	9.32	F	4	1

[a] age in months

[b] using Hollingshead's (1975) four factor scale of social position, on a scale from 1 to 5, where 1 is the lowest and 5 is the highest SES rating.

[c] 1=white, 2=black, 3=other

Table C 3

ELD Group

Subject #	Age [a]	DSS	Sex	SES [b]	Ethnicity [c]
015	96	6.84	M	3	1
019	95	6.91	M	3	1
093	95	6.84	M	3	1
097	98	6.96	M	3	1
101	95	7.68	M	3	1

[a] age in months

[b] using Hollingshead's (1975) four factor scale of social position, on a scale from 1 to 5, where 1 is the lowest and 5 is the highest SES rating

[c] 1=white, 2=black, 3=other

APPENDIX D

COMPLEX PHONOLOGICAL PRODUCTION TASKS

Source: Catts, H (1986). Speech production/phonological deficits in reading disordered children. Journal of Learning Disabilities, 19, 504-508.
Adapted by Paul, R. (1995). Language disorders from infancy through adolescence. St. Louis: Mosby-Year Book.

Naming task. Have student name pictures of the following:

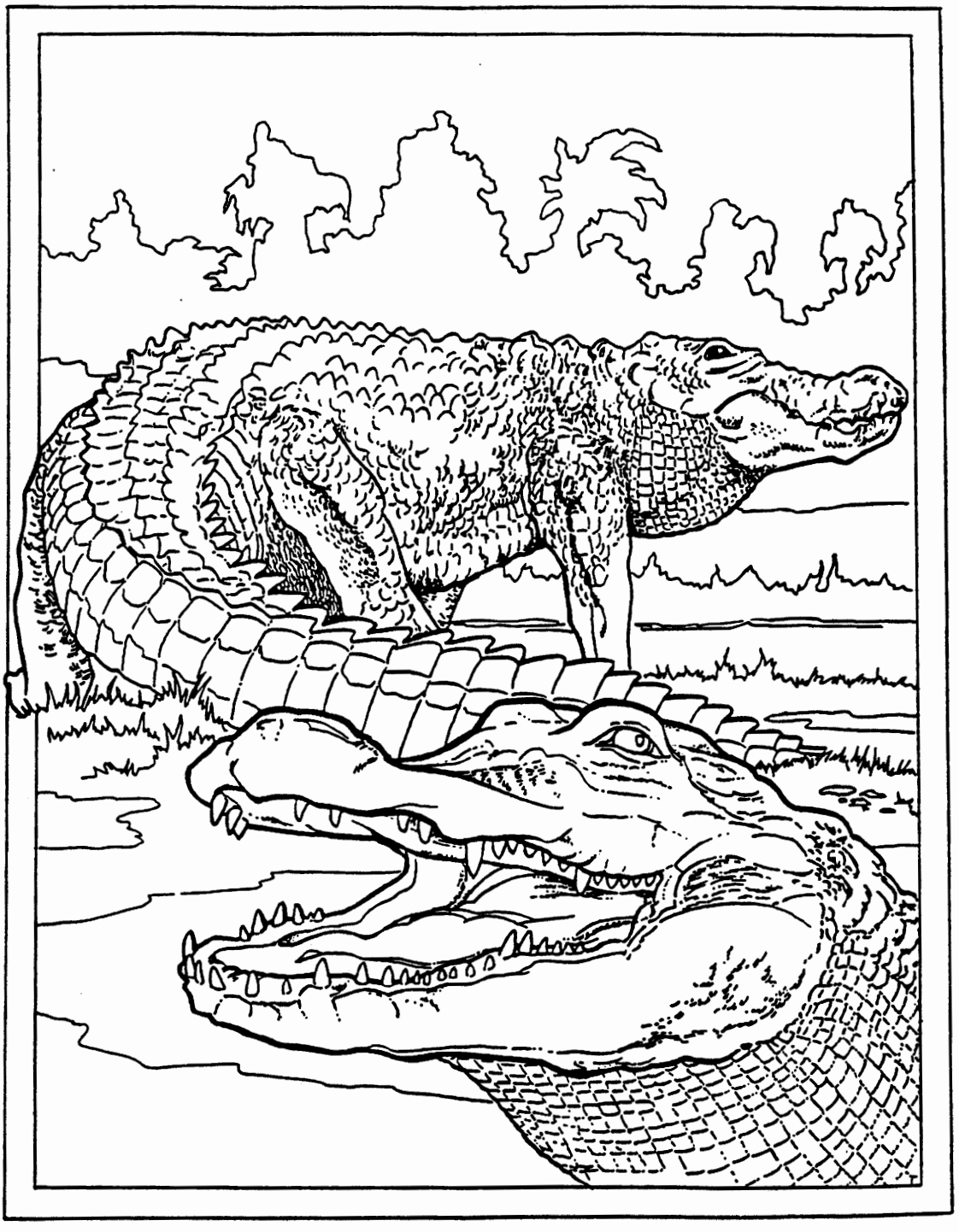
alligators	vegetables	domino
stethoscope	octopus	gorilla
helicopter	dinosaur	volcanoes
submarine	asparagus	valentine
kangaroo	hippopotamus	ambulances
buffalo	ornaments	aquarium
rhinoceros	broccoli	

Word repetition task. Say each word and have the student repeat it.

peculiar	aluminum	probably
Colorado	cinnamon	calendar
orchestra	symphony	syllable
animal	specific	enemy
catalog	governor	fudgesickle
permanent	pistachio	pneumonia
navigator	especially	

Phrase repetition task. Say each phrase and have the student repeat it.

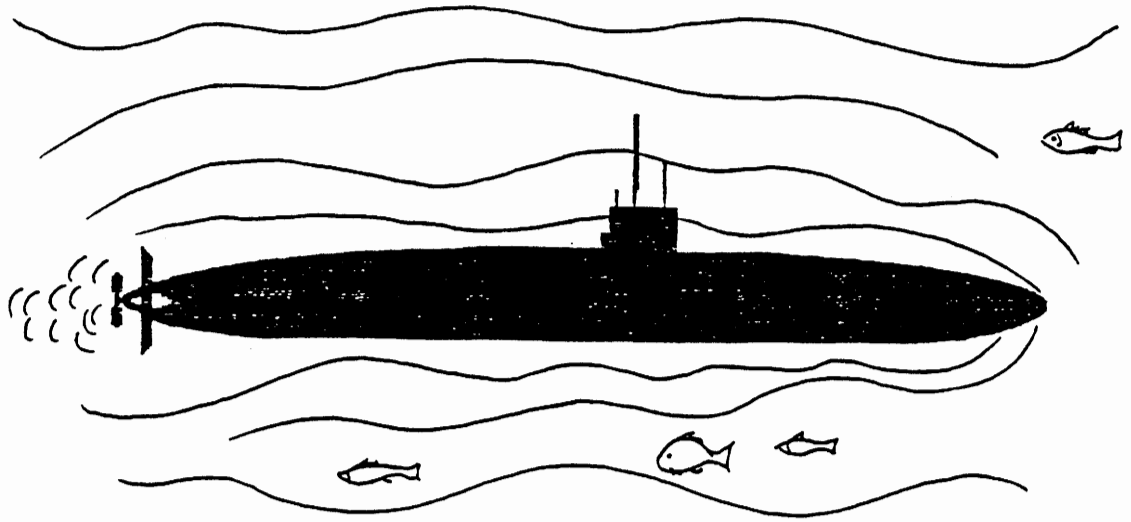
Fly free in the Air Force.
A box of mixed biscuits.
Six slim sailors.
Have some fried flounder.
Shiny seashell necklace.
Big black bugs' blood.
Wash each dish twice.
He likes split pea soup.
He skied down the snow slope.
Tom threw Tim three thumbtacks.



ALLIGATORS

STETHOSCOPE

HELICOPTER



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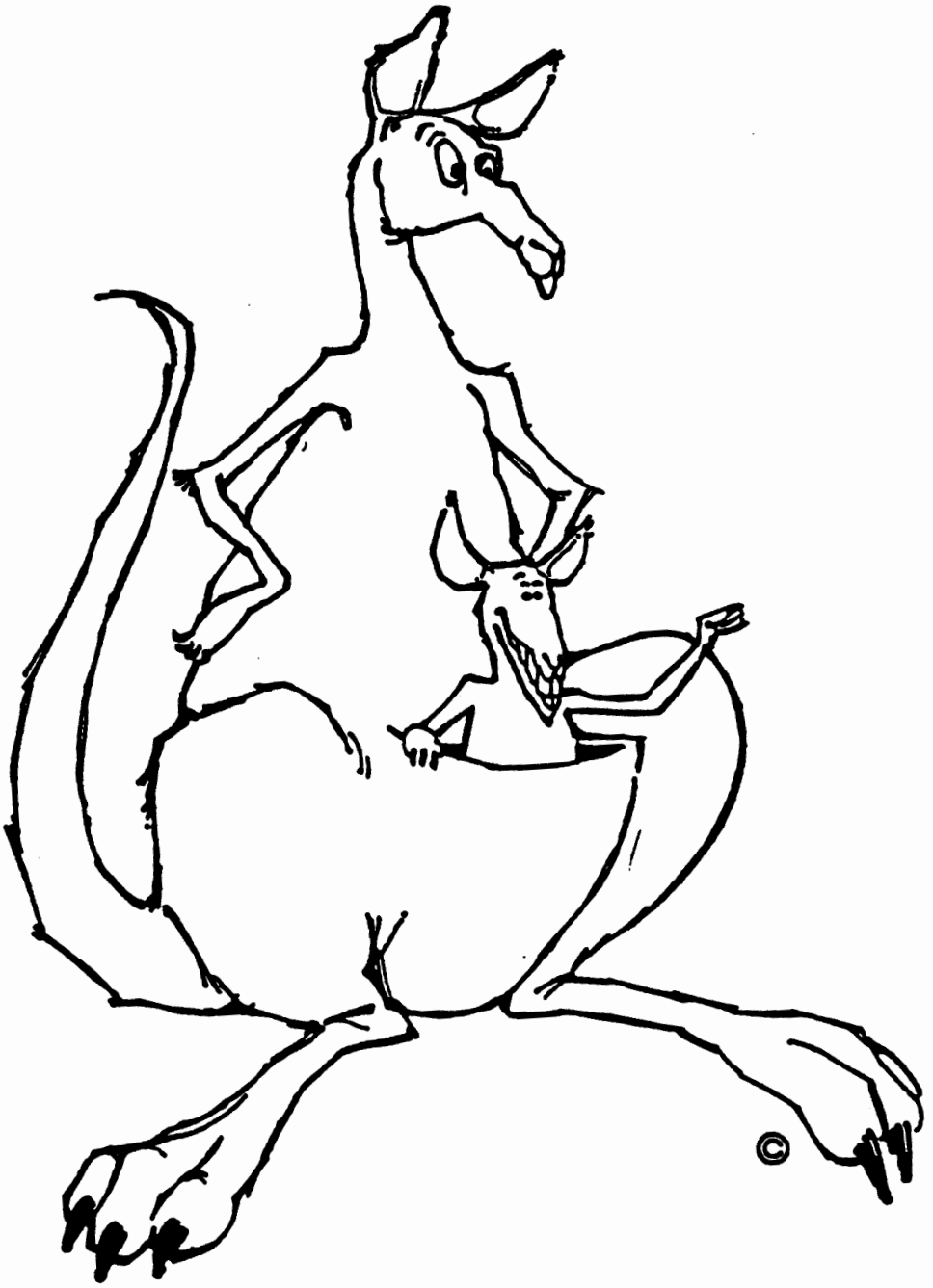

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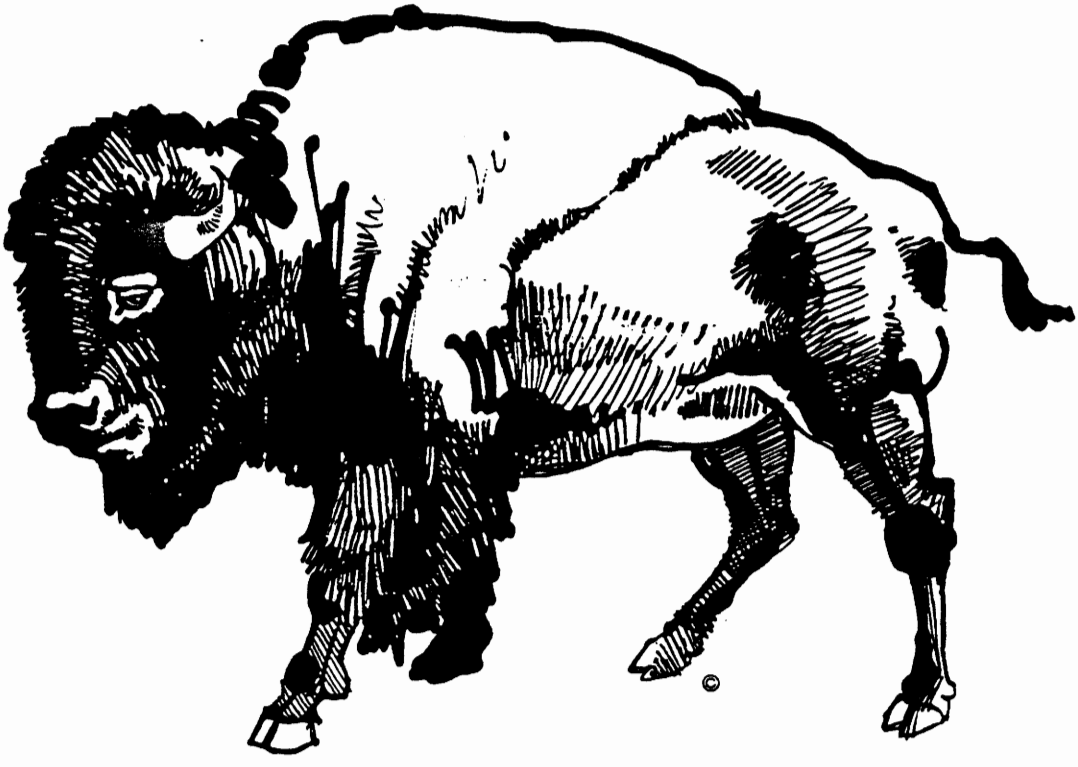

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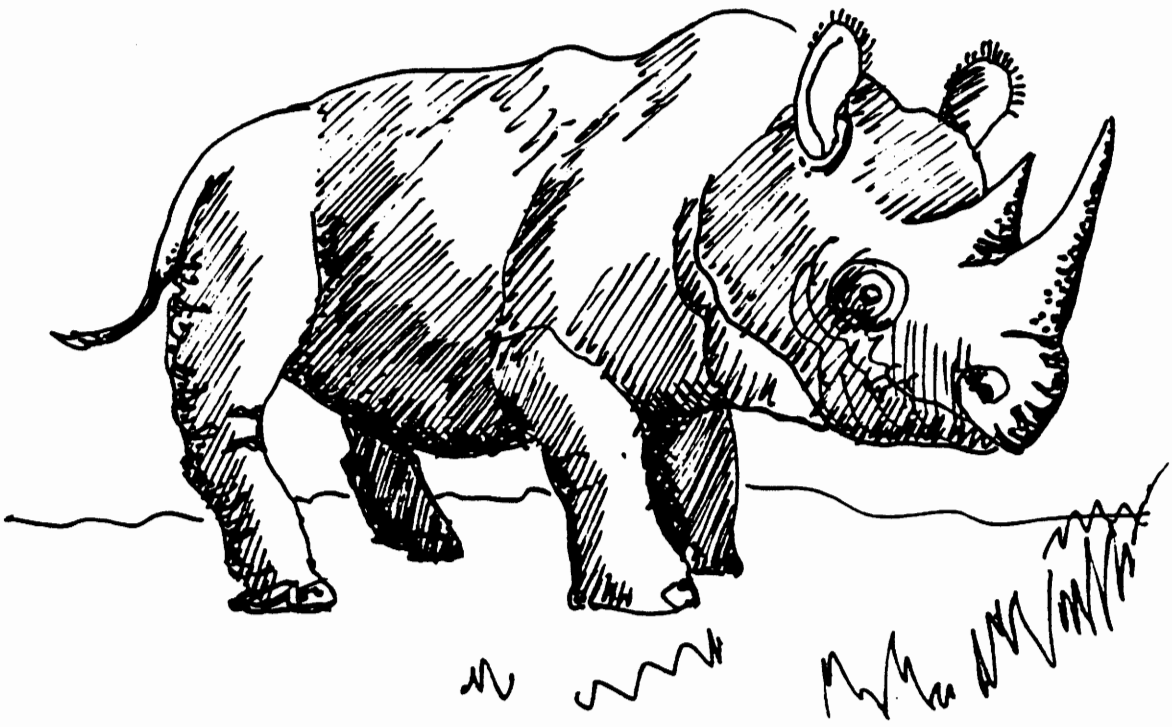

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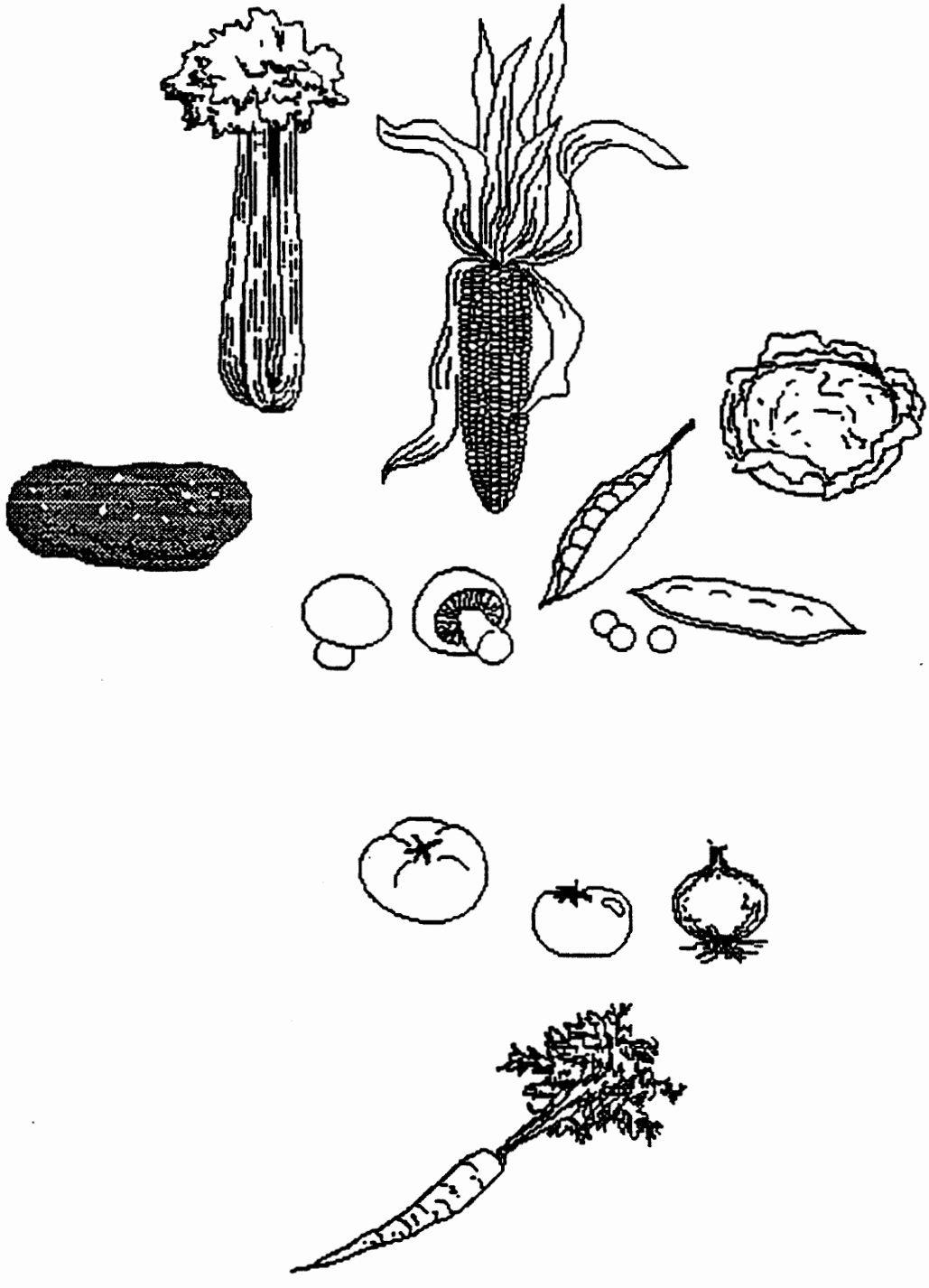

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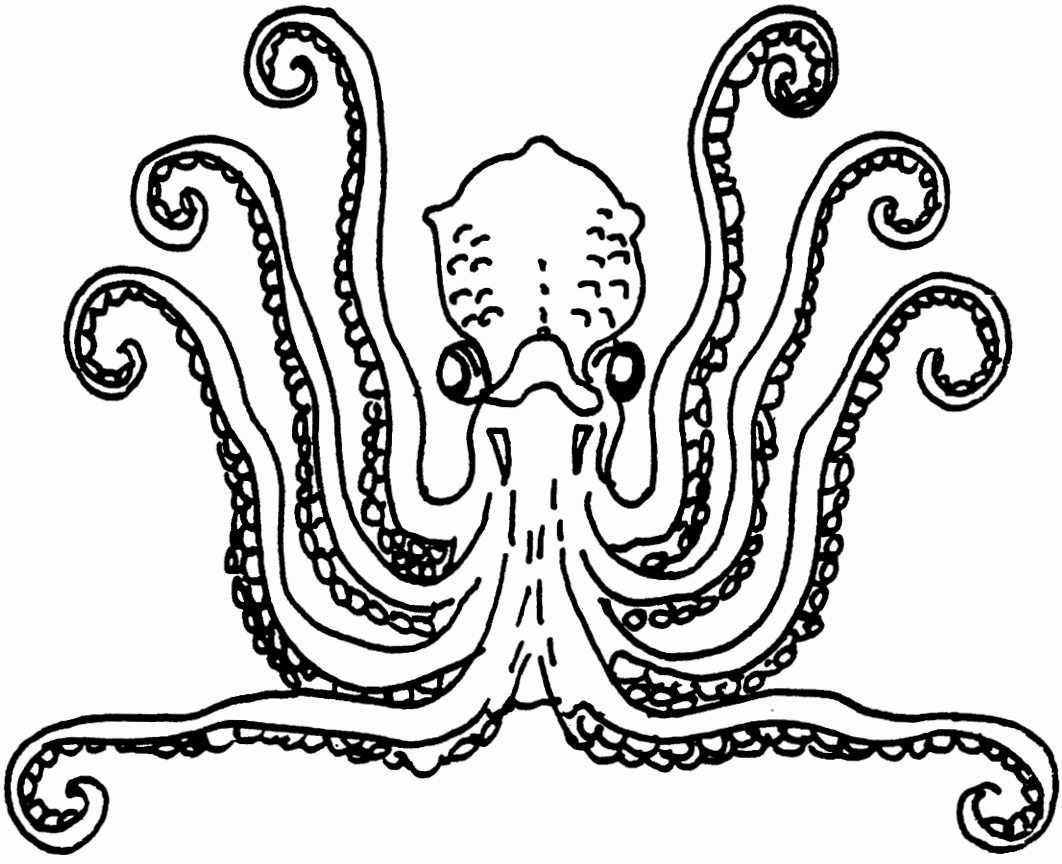

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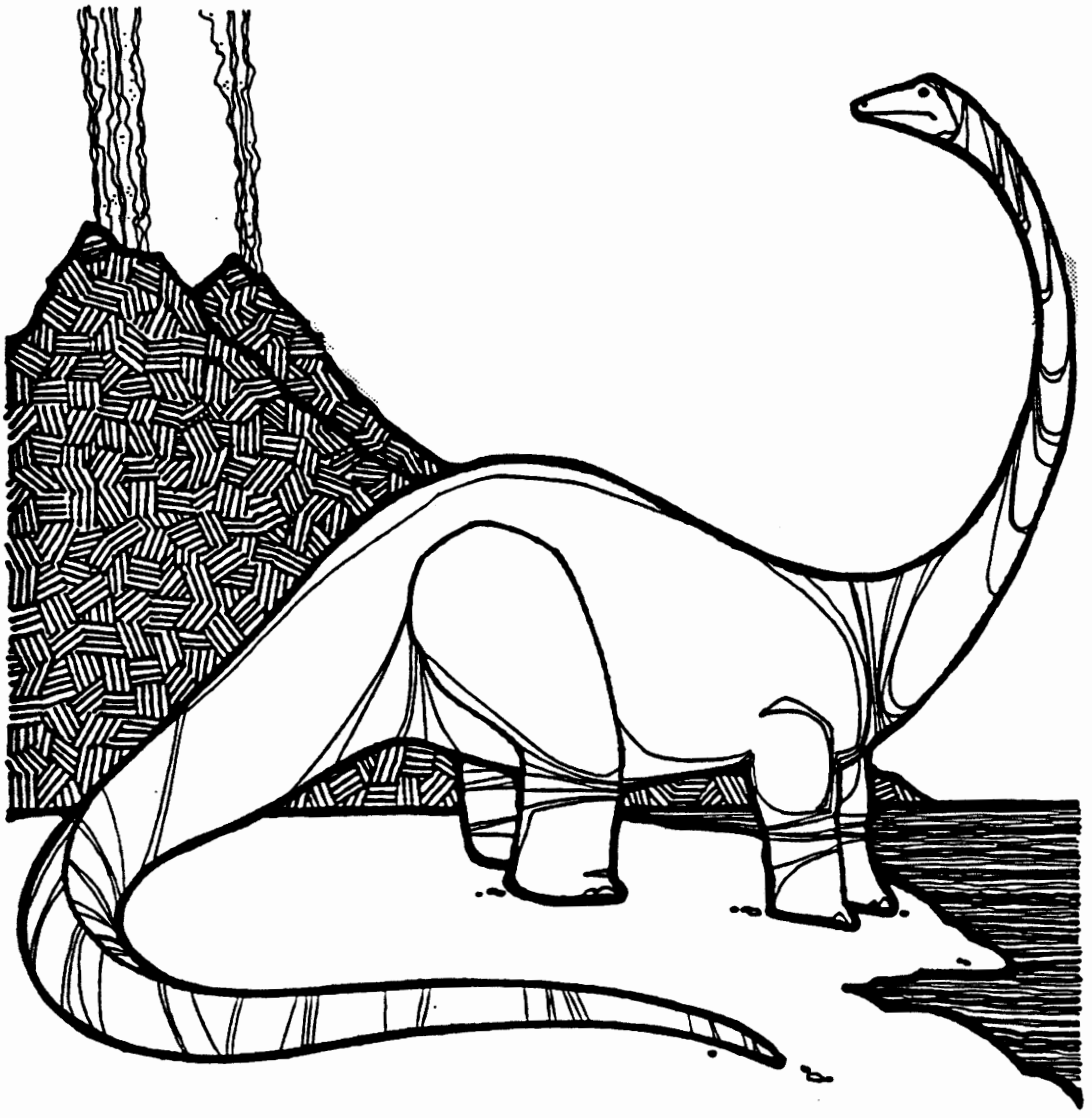
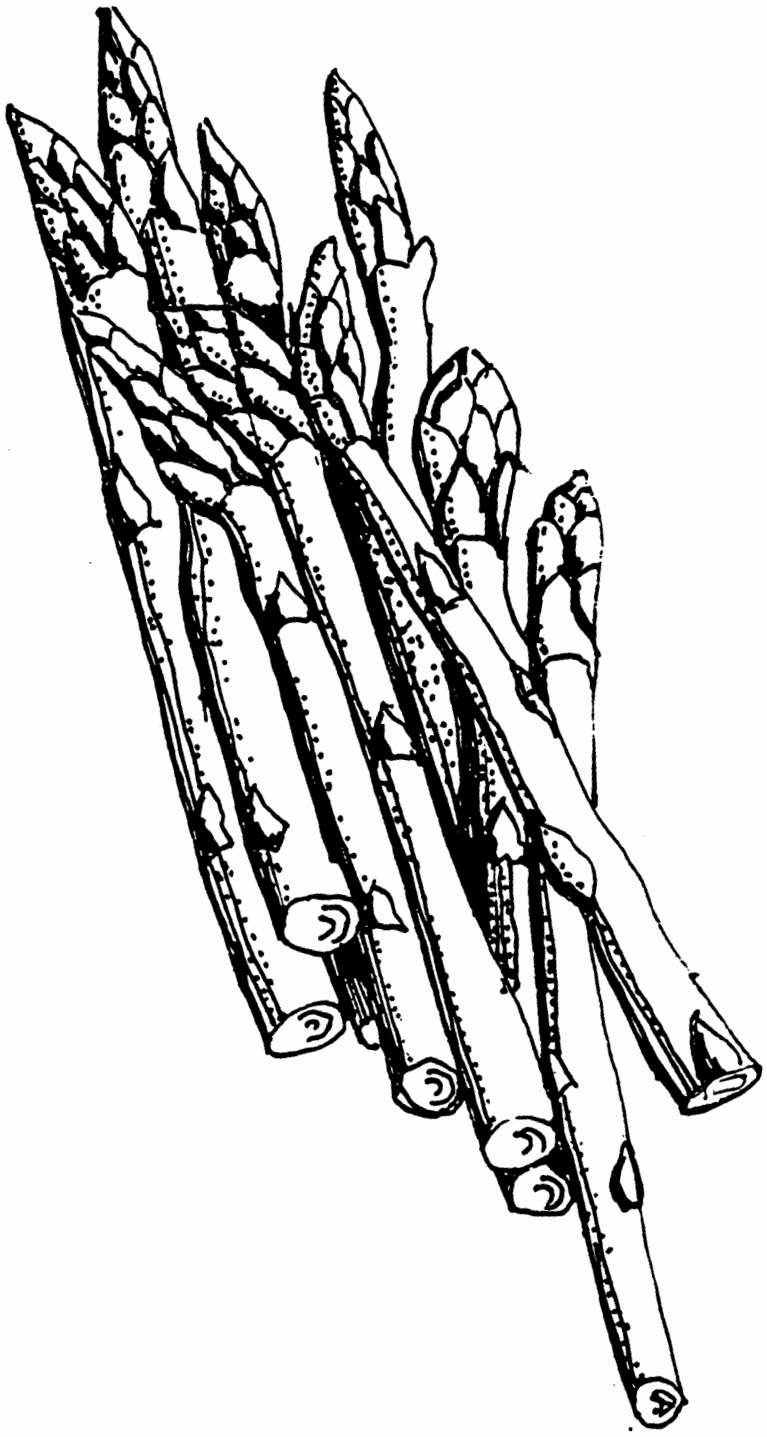


DINOSAUR



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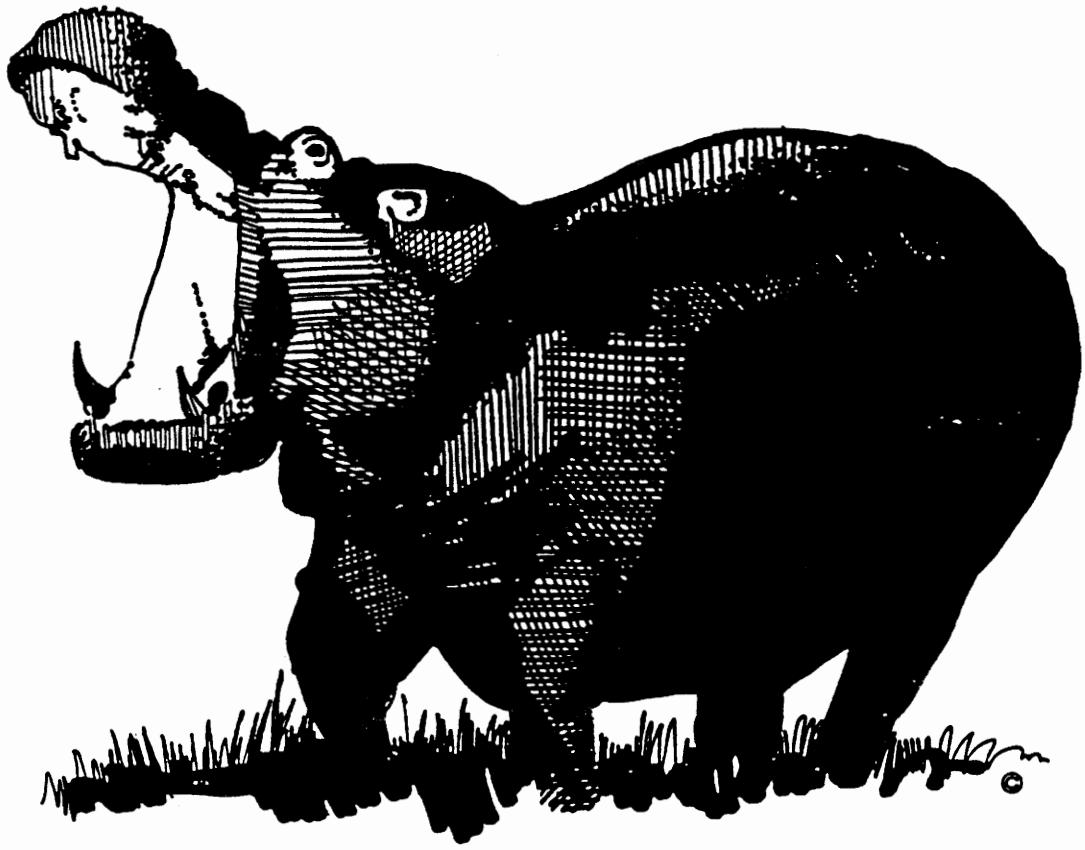

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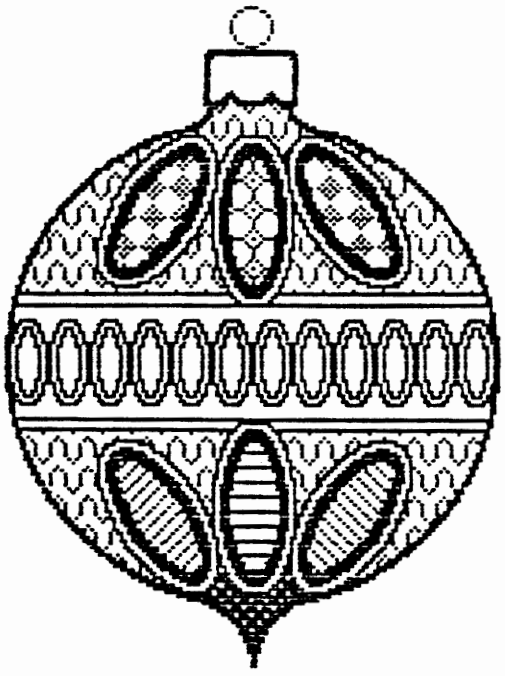

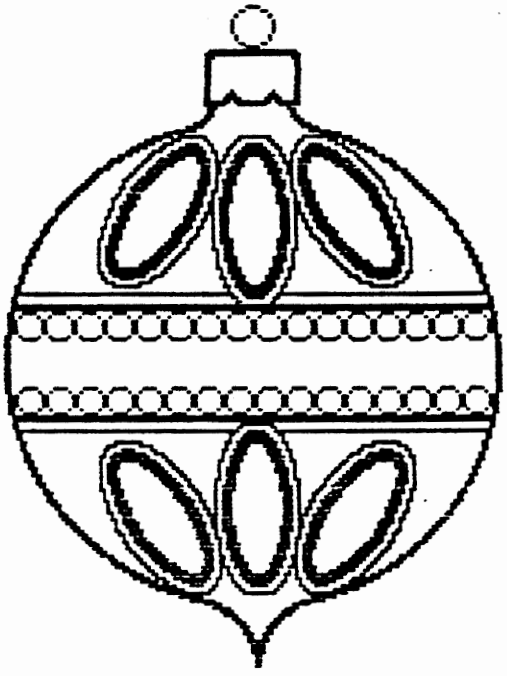

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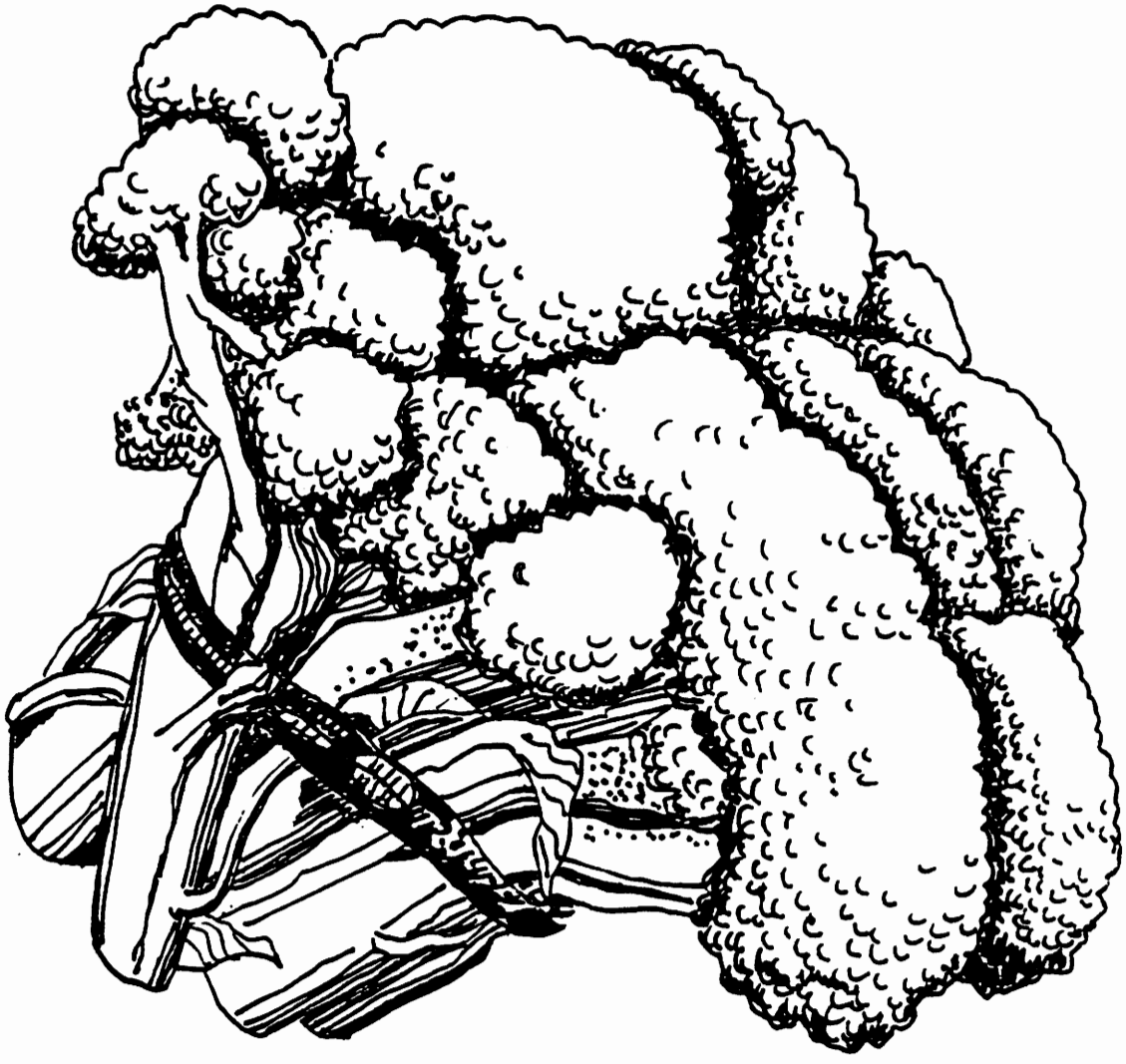
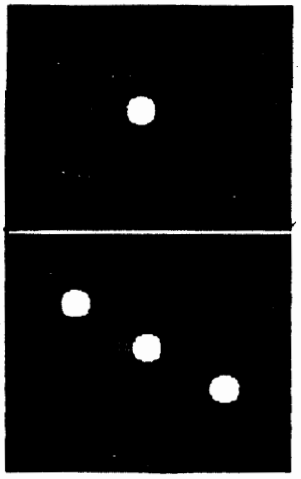
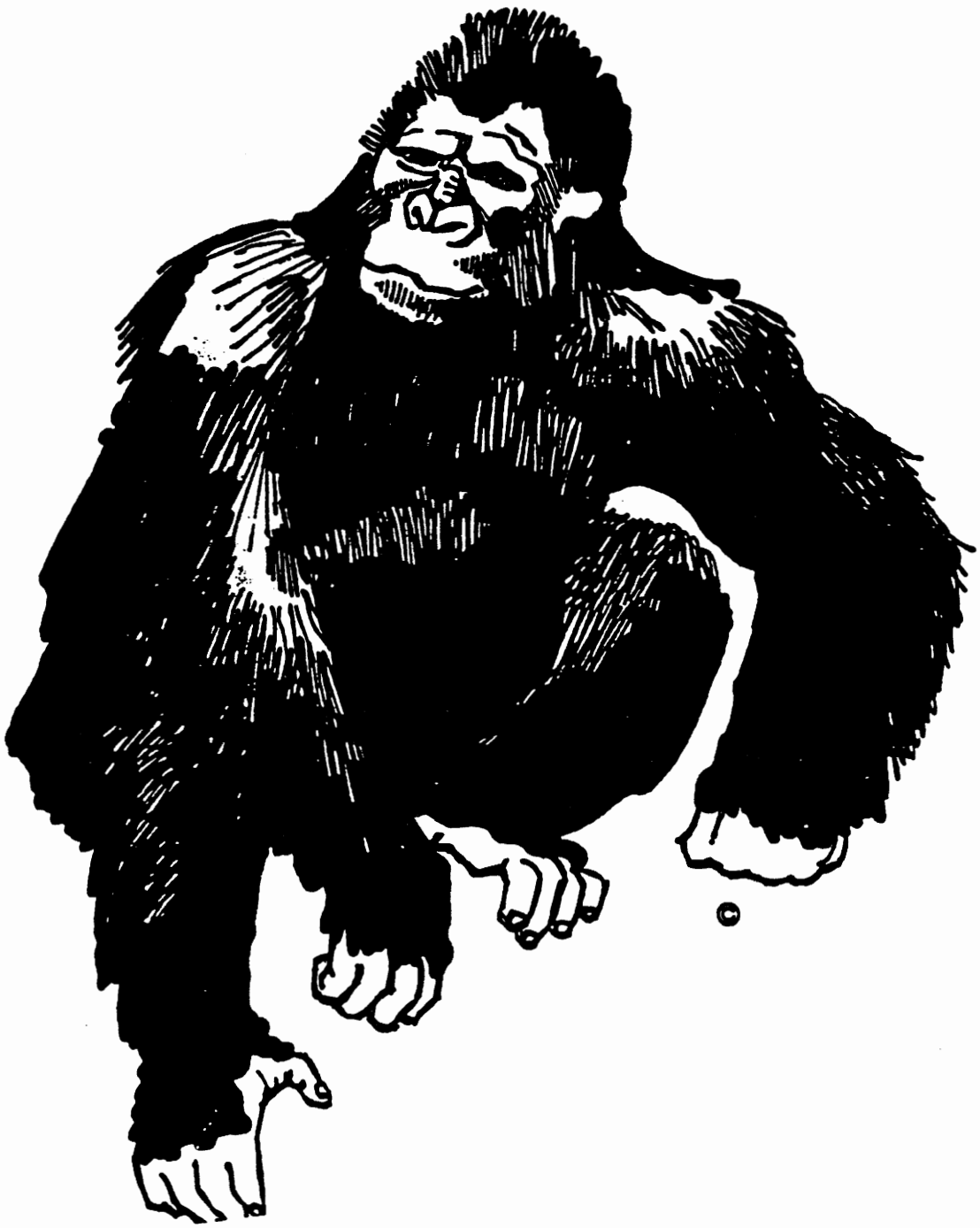


BROCCOLI

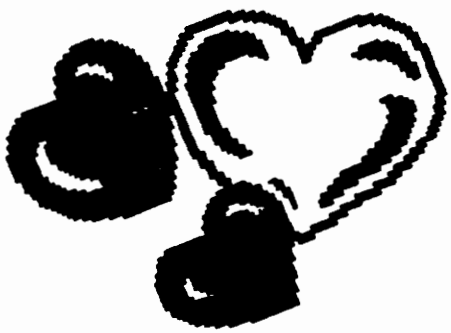


DOMINO

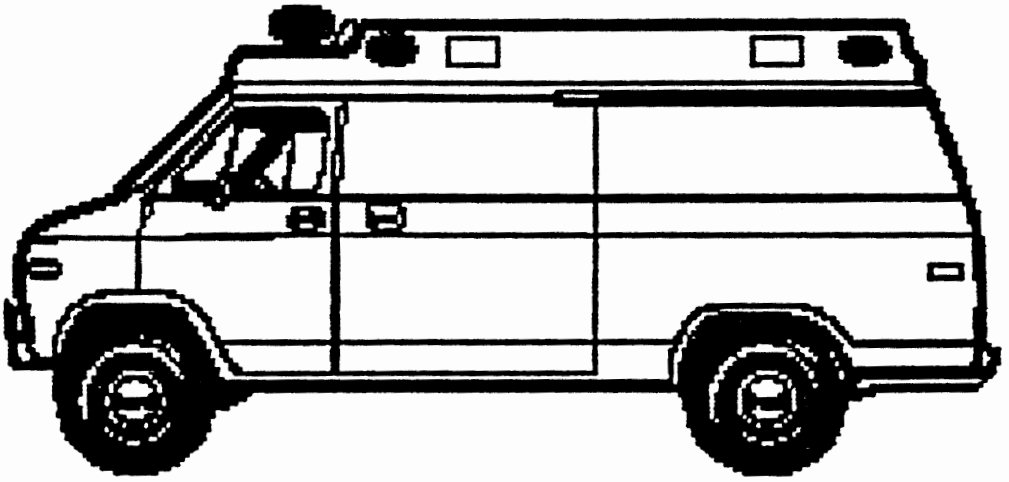


GORILLA

VOLCANOES



VALENTINE



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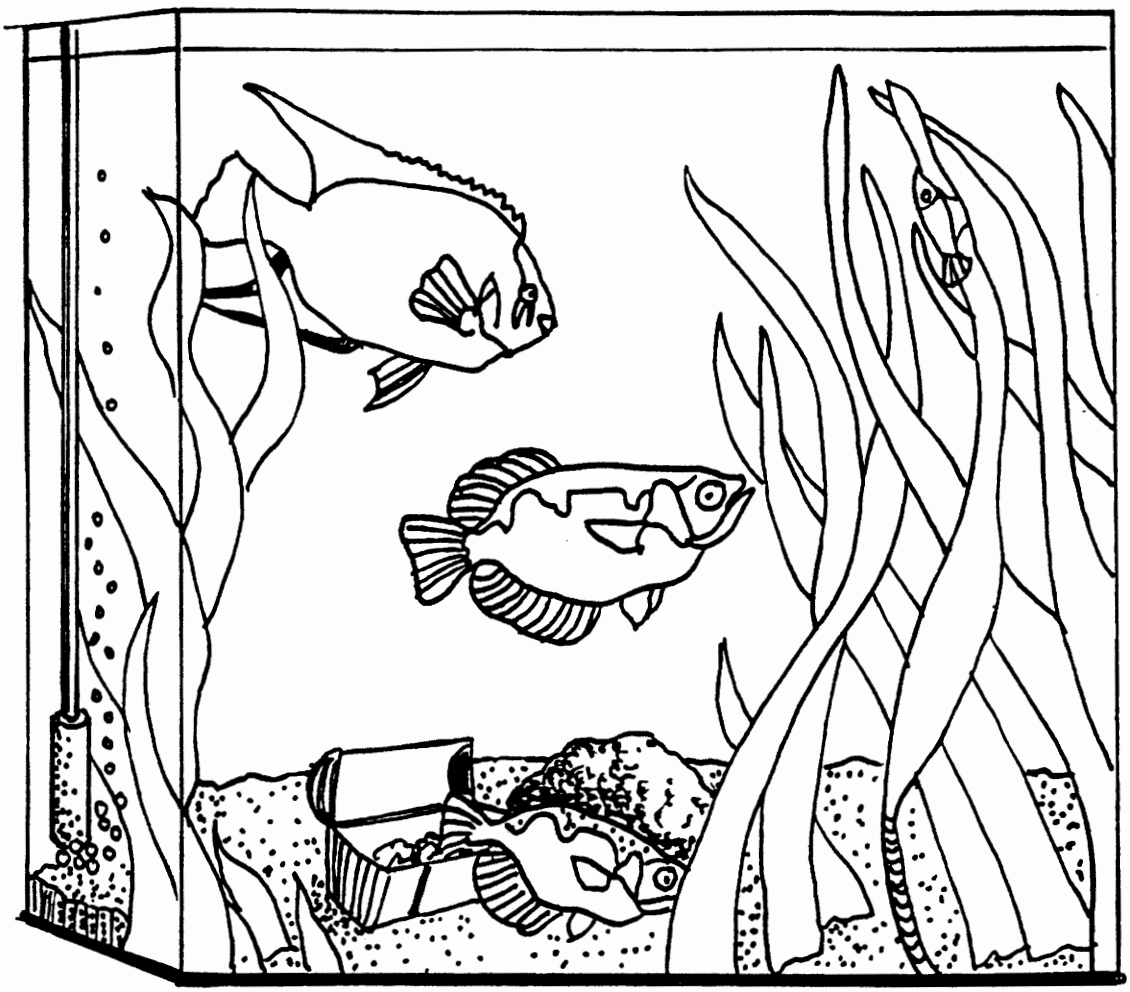

AQUARIUM

APPENDIX E

RAW DATA

Table E1

Normal Group Test Scores Collected from Second Grade Evaluation

Subject	LAC	Naming	Repetition	Phrases	RR	RC
004	52	92	83	41	78	86
009	42	94	81	37	80	87
014	58	95	85	43	88	94
027	55	96	86	39	115	116
036	82	94	82	44	123	131
040	94	94	87	44	119	117
051	76	85	74	38	102	107
055	94	90	82	43	112	113
058	94	86	78	27	111	114
059	85	96	82	41	111	107
063	64	92	77	37	135	126
072	46	95	78	41	107	102
081	70	95	85	43	112	120
095	70	96	85	37	111	102
113	52	94	84	41	115	114
126	94	96	87	44	128	123
128	88	95	86	40	120	128
129	79	95	85	39	119	108
130	79	96	87	40	135	125
131	57	93	83	40	117	114
132	64	95	86	37	123	118
133	94	96	87	44	122	114
138	100	91	87	39	109	109
139	94	96	85	44	135	135
141	88	94	83	39	109	112
144	63	96	81	40	119	120
150	100	94	84	40	135	135

LAC= Lindamood Auditory Conceptualization Test
RR= Reading Recognition
RC= Reading Comprehension

Table E2

HX Group Test Scores Collected from Second Grade Evaluation

Subject	LAC	Naming	Repetition	Phrases	RR	RC
006	57	94	84	42	128	108
007	64	87	78	38	88	99
012	70	94	81	42	111	105
029	55	84	74	33	88	94
039	94	95	83	34	135	108
041	78	96	86	42	118	120
057	51	92	86	40	106	103
084	52	85	82	40	125	118
085	49	90	84	35	102	87
086	68	83	80	39	105	65
087	69	88	81	41	95	110
090	76	90	82	40	131	128
091	61	84	69	30	87	101
092	87	86	78	38	119	116
094	82	91	84	39	117	114
098	81	95	84	42	128	120
100	75	87	78	37	106	109
102	67	91	85	43	92	98
103	88	95	82	39	119	110
105	91	95	86	44	128	121
107	100	96	85	42	135	126
109	82	95	86	40	115	113
111	42	90	77	28	122	112
114	40	92	84	38	86	88
119	94	96	87	41	135	135
122	55	93	79	41	83	98
142	94	88	80	41	128	113

LAC= Lindamood Auditory Conceptualization Test
RR= Reading Recognition
RC= Reading Comprehension

Table E3

ELD Group Test Scores Collected from Second Grade Evaluation

Subject	LAC	Naming	Repetition	Phrases	RR	RC
015	19	86	74	30	95	110
019	37	93	80	39	74	83
093	64	94	81	42	123	109
097	63	92	82	38	84	99
101	64	94	85	43	128	117

LAC= Lindamood Auditory Conceptualization Test
RR= Reading Recognition
RC= Reading Comprehension